Embracing Technology to Improve Mobility

California developed its highway system during the post-war economic boom a half-century ago. As the state's population and economy grew, so did the highway system. Those days are over. Now we have to use what we have more efficiently.

In 2013, we experienced approximately 300,000 daily vehicle hours of delay across the state, where speeds dropped below 35 miles per hour. By 2023, we estimate delays will increase by 120,000 hours to 420,000 daily hours statewide, a 40 percent increase. Those delays contribute to a loss in the overall state economy, with costs expected to increase from $1.5 billion to $2.1 billion annually, while annual carbon dioxide emissions will increase from 1.3 million metric tons to 1.8 million metric tons.

To manage the growing demands on the system, we turn to technological advances in traffic management to increase efficiency, safety, and reliability.

What Is The Transportation Management System?

The transportation management system is a combination of electrical field elements, communications and central applications remotely monitored and controlled from one of our 12 transportation management centers in California. Also known as intelligent transportation systems or ITS, these include ramp meters, traffic signals, vehicle detection stations, changeable message signs, closed-circuit television cameras, highway advisory radios, roadway weather information systems, communication devices, and central traffic management systems.

Knowing the presence, speed, and length of vehicles on the road is critical to effectively manage safety and roadway congestion. We use vehicle detection

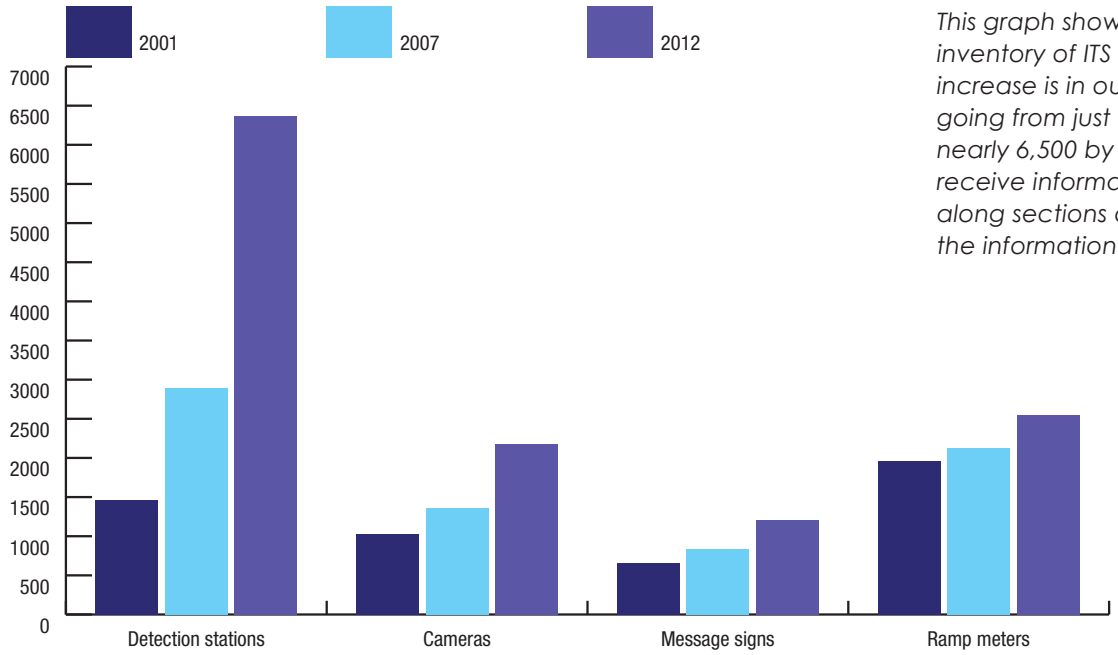
sensors in real time to measure traffic volume and adjust traffic light timing at intersections and onramps. We also use them for traveler information systems, such as the changeable message signs on roadways and QuickMap, the web-based interactive map. The collected sensor data helps determine where to invest the limited money available. Thousands of closed-circuit television cameras continuously monitor the roads and provide video feeds to local media outlets and snapshots on QuickMap. We use roadway weather information systems to monitor highway and weather conditions within a region and to prepare for heavy rains and snow plowing.

What This Means for the California Motorist

- Cameras help verify incidents 10 minutes faster.
- For every minute faster an incident is cleared, drivers generally save four minutes of delay.
- Changeable message signs warning drivers to use detours due to work zones and collisions can save five to 30 minutes of delay. This also reduces secondary collisions and related delay.
- Accurate traffic data allows construction work to be scheduled so they cause less delay.
- Ramp meters reduce delay by up to 30 percent in some corridors.

In this video, Caltrans Director Malcolm Dougherty visits Caltrans' newest Transportation Management Center in Fontana. He showcases the award-winning LEED center and the technology Caltrans uses around the state to manage California's transportation system. To view the video, visit www.dot.ca.gov/ctjournal/MileMarker/index.html.

Total ITS Elements Added by Year



This graph shows the increase in Caltrans' inventory of ITS elements. The greatest increase is in our detection stations, going from just under 1,500 in 2001 to nearly 6,500 by 2012. Detection stations receive information from traffic detectors along sections of highway, then send the information to transportation

Percentage of Traffic Management Tools in Working Order

		Caltrans District											
ITS Element	**Statewide Total %**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Vehicle Detection Sensors	**66**			75	50	63	53	63	61		71	84	82
Camera	**87**	100	90	92	70	99	71	87	93	100	97	90	98
Changeable Message Sign	**89**	68	97	96	92	94	87	88	83	100	92	92	82
Highway Radio	**86**	100	95	89	62		92	100	100	100	100	100	100
Road Weather Station	**86**	100	65	71			93		100	100	90		
Single-Message Flashers	**96**	99	100	84	99		100	100	100	97	74		100
Ramp Meters	**84**			98	80	100	42	74	94		100	95	99

The ITS elements used for traffic management vary, and this table shows the percentage of our operational elements by type. Blank areas have no ITS elements.

Smarter Systems for Better Performance

Modern traffic management systems help us optimize efficiency, safety and reliability — benefits that also reduce air pollution. These systems help us manage traffic, respond quickly to traffic incidents and improve traffic flow. Healthy intelligent transportation systems are systems that work properly. When used on California's roadways, these systems:

- Use existing roads more efficiently and improve traffic flow.
- Lessen overall and peak travel times and make travel times more reliable.
- Improve emergency response and incident clearance time.
- Lower greenhouse gas emissions.
- Reduce vehicle collisions.

Most Components Function Properly

Our transportation management system inventory will continue to evolve. Since 2007, Caltrans and its local partners have installed more than 5,000 additional system elements such as detection stations, cameras, changeable message signs, ramp meters, and central control systems. To date, we have more than 13,000 system elements. Engineers and maintenance crews work to keep this complex system working. Naturally, as the system becomes more complex, maintaining it becomes more challenging. Current staffing levels cannot keep up with the maintenance demand. As the inventory ages, it becomes more difficult to troubleshoot and keep old elements compatible with the new systems, thus requiring replacement. On average, 87 percent of transportation management system field elements are operational, and 66 percent of our traffic detectors are operational. In addition to an aging infrastructure, numerous challenges, such as construction activity, equipment failure, accidents and copper theft, can cause interruptions in transportation management system performance.

Copper wire theft is a national epidemic

Losses associated with copper wire theft are estimated at more than $1 billion annually. Copper wire and metal theft has been a growing problem in California as the price of copper has risen 350 percent over the past five years. Thieves rip out metal and copper wire from lights, signs, metering lights, traffic sensors, and all kinds of equipment and electrical systems. In 2012, Caltrans allocated more than $50 million for repairs and equipment associated with copper wire theft. When we make repairs, we also install deterrents to prevent future theft.

Committed to Increasing System Performance

Investing in replacing and upgrading elements to keep the system in good repair is part of our "fix-it-first" philosophy. Beginning in fiscal year 2015–16, State Highway Operation and Protection Program funds will be invested in upkeep and improvements to the traffic management system. This matters a great deal to Californians because effective traffic management systems reduce the amount of time motorists are stuck in traffic.

Source: Division of Traffic Operations